Systematic approach to Fetal Echocardiography.

Pediatric Echocardiography Conference, JCMCH
November 7, 2015
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Objectives

- Fetal cardiology pre-test
- Introduction
- Embryology and Physiology of fetal heart
- Timing of procedure
- Indications
- Basic fetal echo procedure/technique
- Cases
- Conclusions
Introduction

- CHD is the most common birth defect
- Incidence is about 8 to 9/1000 live births
- Most neonates with CHD have no pre-identified risk factor, but several risk factors are known to cause cardiac defects (indications for fetal echo)
- Screening test required for all pregnancies (basic 4 chamber & extended basic 2nd trimester OB ultrasound)
- Overall better outcome has been found with pre-natal detection of CHD
- Early pre-natal diagnosis needed for possible fetal cardiac surgery
Embryology of the heart

- Human heart is morphologically complete by 8wks post conception. Heart beat starts at 4wks
Cardiac Size

20 week fetus’ heart compared with an American quarter
Usual HR 120-160/min
Physiology – Fetal Circulation

Essential pathways of fetal circulation:
- Fossa ovalis (PFO)
- Ductus (PDA)

NEVER TRUST A NEONATE
Physiology- cont.

PULMONARY ATRESIA

HYPOPLASTIC LEFT HEART SYNDROME
Timing & Indications for Fetal echo

- **Timing**: Optimum time 18 to 22 wks. (>30 wks difficult as fetus crowded in the amniotic cavity)

- **Reasoning**: Heart large enough to see details, ribs not as dense, varied positions

- **Indications**: Maternal risk factors
  Fetal risk factors
  Familial risk factors
Maternal risk factors

- Maternal congenital heart disease
- Cardiac teratogen exposure eg, lithium, folate antagonists, organic solvents, thalidomide, anticonvulsants, isotretinoin, paroxitene
- Maternal medical illness eg, diabetes, phenylketonuria, anti Ro/SSA or anti La/SSB antibodies (lupus)
Maternal risk factors, cont.

• Exposure to prostaglandin synthetase inhibitors (can cause premature closure of the ductus arteriosus in the third trimester)
• Rubella infection in the first trimester
• In vitro fertilization
Fetal risk factors

• Suspected cardiac anomaly during basic sonogram
• Extracardiac anomaly, Hydrops, Abnormal fetal situs
• Arrhythmia
• Chromosomal anomalies
• Increased nuchal translucency
• Monochorionic twins, with or without twin to twin transfusion syndrome
Familial risk factors

- Previous child with congenital heart disease
- Paternal CHD
- Syndromes that have CHD eg. Noonans, tuberous sclerosis, Digeorges & other autosomal dominant syndromes)
Standard Fetal Heart Procedure

- Evaluate Heart Rate and Function.
- Evaluate the Abdominal and Atrial Situs.
- Evaluate the Atrial-Ventricular Connections.
- Evaluate the Ventricular-Arterial Alignment.
- Evaluate the Great Arteries relationship to each other.
- Sequential segmental analysis
Segmental analysis

4 Segments
- Great veins
- Atria
- Ventricles
- Great arteries

3 Connections
- Venoatrial
- Atrioventricular
- Ventriculoarterial
2-D Screening Fetal Cardiac Exam

- Highest possible transducer frequency & frame rate to maximize image resolution. Adjust focal zone & zoom to area of interest, minimize depth.

- Find 4 chamber view, transverse section through fetal thorax, rotate 90° to obtain short axis.

- Atria & ventricles should be fairly equal in size.

- Floppy foramen ovale tissue/flap in the LA (R→L shunting).

- RV can be identified by the moderator band and should be anterior to the LV.
Fetal cardiac exam- multiple views

• Four/Five chamber- atria, ventricles, septae, pulmonary veins, semilunar valves
• Long axis- superior and inferior vena cava, great vessels, ductus arteriosus
• Short axis/ductal arch- pulmonary veins, caval connections, ductus arteriosus, ventricular outflow, branch pulmonary arteries
• Aortic arch-head vessels
Fetal Chest - 4 Chamber View
2-D Fetal Cardiac Exam

A normal fetal heart is Symmetric, axis 45° left
The outflow tracts cross at around 90°

Pulmonary root

Aortic root
Factors influencing the Quality of the Fetal Echocardiogram

- Maternal Obesity
- Poly/Oligo hydramnios
- Too young or old fetus
- Previous Abdominal Surgery
- Fetal Position
Cases

• Normal fetal echo
• Abnormal 4 chamber views
• Great artery abnormalities
• Miscellaneous
Cardio-thoracic ratio
Cardio-thoracic ratio
4 chamber view
4 chamber view
4 chamber view with pleural effusion
Short axis view
Aortic arch
Aortic arch view
3 vessel view
Abnormal 4 chamber view- HLHS
AV CANAL
Abnormal 4 chamber- VSD
VSD
VSD in short axis
VSD in short axis
RHABDOMYOMA
Conclusion

- Pts. with abnormal OB scan, pts. at risk of having an infant with CHD - All need in-depth fetal echocardiogram
- Identifying cardiac infants prior to birth, with delivery at tertiary cardiac centers have an overall better prognosis
- Families are better prepared and know what to expect
- Most of the time Fetal echo is a fun game of puzzle